

**We claim:**

1. An electrical stimulator for the treatment of intractable pain syndromes,  
comprising:

an interferential current generator for generating an interferential alternating  
5 current output by using common sine wave generators with a base medium frequency of  
at least 500Hz but no more than 20KHz; and

at least two pairs of implantable electrodes connected to said interferential  
current producing generator and located at predetermined locations on a subject's spinal  
cord wherein each pair of implantable electrodes produces a separate electrical circuit.

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2. The stimulator of claim 1, wherein said interferential current generator  
comprises:

a pulse generator that generates digital signal pulses; and  
a digital signal processor connected to said pulse generator that processes the  
15 digital signal pulses to approximate a sine-wave-like output waveform.

3. The stimulator of claim 1, wherein said interferential current generator  
comprises:

a pulse generator that generates digital signal pulses; and  
20 a field-programmable gate array connected to said pulse generator that  
processes the digital signal pulses to approximate a sine-wave-like output waveform.

4. The stimulator of claim 1, wherein said interferential current includes a resultant  
beat frequency of no more than 250 Hz.

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5. The stimulator of claim 1, wherein said interferential current includes a voltage output of 11 volts maximum for each circuit.
6. The stimulator of claim 1, wherein said interferential current includes a pulse width of 210 microseconds.
7. The stimulator of claim 1, wherein said interferential current includes a pulse width with a range of at least 10 microseconds but no more than 600 microseconds.
8. The stimulator of claim 1, wherein two quadripolar leads are used to produce two interferential currents.
9. An electrical stimulator for the treatment of intractable pain syndromes, comprising:
- 15 a pulse generator that generates digital signal pulses;
- a digital signal processor connected to said pulse generator that generates a sine-wave-like output waveform that is further processed into first and second circuits; and
- two pairs of implantable electrodes connected to said digital signal processor and positioned on a subject's spinal cord at predetermined locations to produce an
- 20 interferential current output waveform from said first and second circuits.
10. The stimulator of claim 9, wherein said interferential current output waveform includes a base medium frequency of at least 500Hz but no more than 20KHz.

11. The stimulator of claim 9, wherein said interferential current output waveform includes a resultant beat frequency of no more than 250 Hz.
12. An electrical stimulator for the treatment of intractable pain syndromes,  
5 comprising:  
a pulse generator that generates digital signal pulses;  
a field-programmable gate array connected to said pulse generator that generates a sine-wave-like output waveform that is further processed into first and second circuits; and  
10 two pairs of implantable electrodes connected to said field-programmable gate array and positioned on a subject's spinal cord at predetermined locations to produce an interferential current output waveform from said first and second circuits.
13. The stimulator of claim 12, wherein said interferential current output waveform  
15 includes a base medium frequency of at least 500Hz but no more than 20KHz.
14. The stimulator of claim 12, wherein said interferential current waveform includes a resultant beat frequency of no more than 250 Hz.
- 20 15. An electrical stimulator for the treatment of intractable pain syndromes, comprising:  
an interferential current generator for generating an interferential alternating current output with a base medium frequency of at least 500Hz but no more than 20KHz; and

at least two pairs of implantable electrodes connected to said interferential current producing generator and located at predetermined locations on a subject's dorsal column wherein each pair of implantable electrodes produces a separate electrical circuit.

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16. The stimulator of claim 15, wherein said interferential current generator comprises:

a pulse generator that generates digital signal pulses; and

a digital signal processor connected to said pulse generator that processes the

10 digital signal pulses to approximate a sine-wave-like output waveform.

17. The stimulator of claim 15, wherein said interferential current generator comprises:

a pulse generator that generates digital signal pulses; and

15 a field-programmable gate array connected to said pulse generator that processes the digital signal pulses to approximate a sine-wave-like output waveform.

18. The stimulator of claim 15, wherein said interferential current includes a resultant beat frequency of no more than 250 Hz.

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19. The stimulator of claim 15, wherein said interferential current includes a voltage output of 11 volts maximum for each circuit.

20. The stimulator of claim 15, wherein said interferential current includes a pulse  
25 width of 210 microseconds.

21. The stimulator of claim 15, wherein said interferential current includes a pulse width with a range of at least 10 microseconds but no more than 600 microseconds.
- 5 22. The stimulator of claim 15, wherein two quadripolar leads are used to produce two interferential currents.
23. An electrical stimulator for the treatment of intractable pain syndromes, comprising:
- 10 a pulse generator that generates digital signal pulses;  
a digital signal processor connected to said pulse generator that generates a sine-wave-like output waveform that is further processed into first and second circuits; and  
two pairs of implantable electrodes connected to said digital signal processor and positioned on a subject's dorsal column at predetermined locations to produce an  
15 interferential current output waveform from said first and second circuits.
24. The stimulator of claim 23, wherein said interferential current output waveform includes a base medium frequency of at least 500Hz but no more than 20KHz.
- 20 25. The stimulator of claim 23, wherein said interferential current output waveform includes a resultant beat frequency of no more than 250 Hz.
26. An electrical stimulator for the treatment of intractable pain syndromes, comprising:
- 25 a pulse generator that generates digital signal pulses;

a field-programmable gate array connected to said pulse generator that generates a sine-wave-like output waveform that is further processed into first and second circuits; and

two pairs of implantable electrodes connected to said field-programmable gate array and positioned on a subject's dorsal column at predetermined locations to produce an interferential current output waveform from said first and second circuits.

27. The stimulator of claim 26, wherein said interferential current output waveform includes a base medium frequency of at least 500Hz but no more than 20KHz.

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28. The stimulator of claim 26, wherein said interferential current waveform includes a resultant beat frequency of no more than 250 Hz.

29. A method for the treatment of persistent chronic pain syndromes using electrical stimulation of the spinal cord, said method comprising:

15 connecting a pulse generator to a digital signal processor and supplying digital signal pulses to said digital signal processor which produces a sine-wave-like current waveform which is further processed and output to first and second pairs of implantable electrodes, wherein first and second circuits are created, respectively;

20 positioning said first pair of implantable electrodes on a subject's spinal cord at one set of diagonal corners of a targeted area;

positioning said second pair of implantable electrodes on the subject's spinal cord at the other set of diagonal corners of the targeted area; and

25 creating an interferential current with a base medium frequency of at least 500Hz but no more than 20KHz.

30. The method according to claim 29, wherein said method further includes varying locations of said first and second pairs of implantable electrodes along the spinal cord.

5 31. The method according to claim 29, wherein said method further includes modulating outputs of amplitudes of said first and second circuits.

32. The method according to claim 29, wherein said method includes creating an interferential current with a resultant beat frequency of no more than 250 Hz.

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33. The method according to claim 29, wherein said method includes creating the interferential current with a voltage output of 11 volts maximum for each circuit.

34. The method according to claim 29, wherein said method includes creating the  
15 interferential current with a pulse width of 210 microseconds.

35. The method according to claim 29, wherein said method includes creating the interferential current with a pulse width comprising a range of at least 10 microseconds but no more than 600 microseconds.

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36. The method according to claim 29, wherein said method includes creating two interferential currents by using two quadripolar leads.

37. A method for electrical stimulation of the spinal cord, said method comprising:

connecting a pulse generator to a digital signal processor and supplying digital signal pulses to said field-programmable gate array which produces a sine-wave-like current waveform which is further processed and output to first and second pairs of implantable electrodes, wherein first and second circuits are created, respectively;

5            positioning said first pair of implantable electrodes on a subject's dorsal column at one set of diagonal corners of a targeted area;

             positioning said second pair of surface electrodes on the subject's dorsal column at the other set of diagonal corners of the targeted area; and

             creating an interferential current with a base medium frequency of at least  
10    500Hz but no more than 20KHz.

38.    The method according to claim 37, wherein said method further includes varying positions of said first and second pairs of implantable electrodes along the dorsal column.

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39.    The method according to claim 37, wherein said method further includes modulating outputs of amplitudes of said first and second circuits.

40.    The method according to claim 37, wherein said method includes creating an  
20    interferential current with a resultant beat frequency of no more than 250 Hz.

41.    The method according to claim 37, wherein said method includes creating an interferential current with a pulse width of 210 microseconds.



42. The method according to claim 37, wherein said method includes creating two interferential currents by using two quadripolar leads.